When writing up your solutions, keep in mind the problem documentation requirements (Slide 6 of the Lecture 1 presentation).

Turn in your homework (typeset, printed, and stapled, with your name, student number, and section) by 12:00 Noon on the due date. Homework collection boxes will be in either Prof. Reed’s office or on the shelf in the lounge area near the faculty offices.

1. (30 points) A Toyota sedan driving on a level road at 100 km/h is placed in neutral (i.e., the engine is disconnected from the wheels). The car continues to move forward but slows down to 80 km/h in 8 seconds.

   (a) Estimate the horizontal force on the car at 90 km/h. Express your answer in newtons.

   (b) Estimate the power the engine must expend to maintain the speed at 90 km/h. Express your answer in horsepower.

2. (20 points) Satellite measurements indicate the North American continent drifts about 1 cm/y. Estimate the kinetic energy of the contiguous United States (all the states + DC except Alaska and Hawaii) from this motion. Compare this energy to the solar energy received by contiguous states over one year. Assume the continent is about 50 km thick, and use the solar energy flux value given in Homework 6.

3. (30 points) Instead of using rockets to put satellites in orbit, you propose to build a 300 km tall tower with an elevator. You could just put the satellite in the elevator, ride it to the top, and push it out.

   (a) Estimate the mass of your tower. Assume it is made of steel and has a base area equal to that of Xiamen island.

   (b) Can your tower support its own weight?

4. (20 points) Compact discs (CDs) have a usable recording area of 90 cm². The information is written as a long spiral track of pits in the plastic material. The picture shows a close-up of the CD surface.

   Calculate the total length of the spiral of pits. (You do not need any more information.)

   Verify you answer using measurements from an actual CD.
Preparation for Next Week

Read Chapters 10 and 11 in Eide.